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(54) Drive reversal mechanism

(57) A reversible drive mechanism typically for use in a crop harvester comprises a rotatable input drive 21 and a rotatable output drive 1. The output drive 1 is normally driven by said input drive 21 via a disengageable drive connection 22, 23, 24, and the input drive 21 and said rotatable output drive means 1 are also connected by a constant mesh epicyclic gear arrangement 3, 5, 11, of which the sun gear 3 is fixed to input drive 21, the ring gear 5 is fixed to the output drive 1. Disengagement of the disengageable drive connection 22, 23, 24 between the input drive 21 and the output drive 1 and the activation of braking means 19, 20 to prevent rotation of the rotatable carrier 15 cause drive to be transmitted to the output drive via the epicyclic gear mechanism 3, 5, 11 such that the direction of rotation of the output drive 1 when driven via the epicyclic gear arrangement 3, 5, 11 is opposite to the direction of rotation when it is normally driven. In an alternative emb diment the brake is constituted by a fixed belt which engages a V-pulley on the carrier, this moving the two parts of the pulley apart to disengage a clutch.

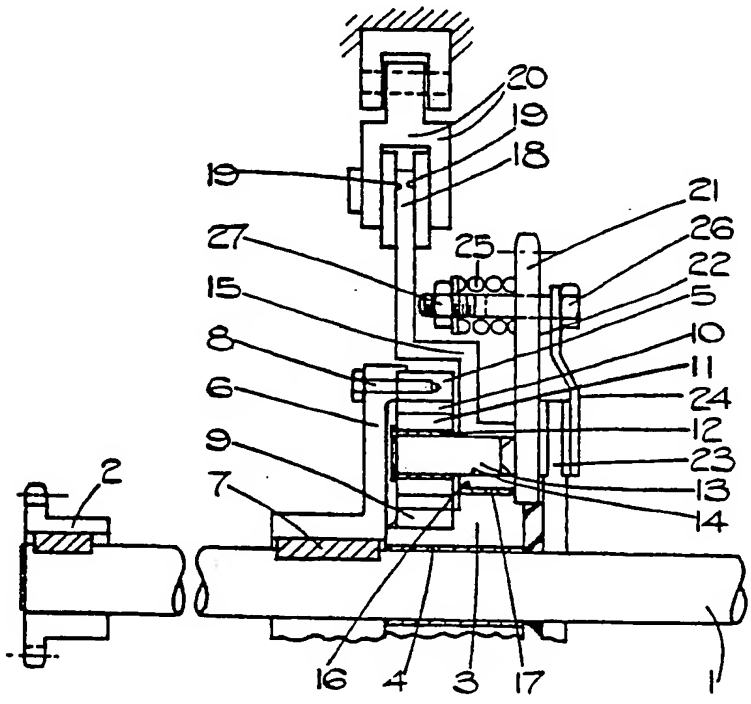

FIG.1

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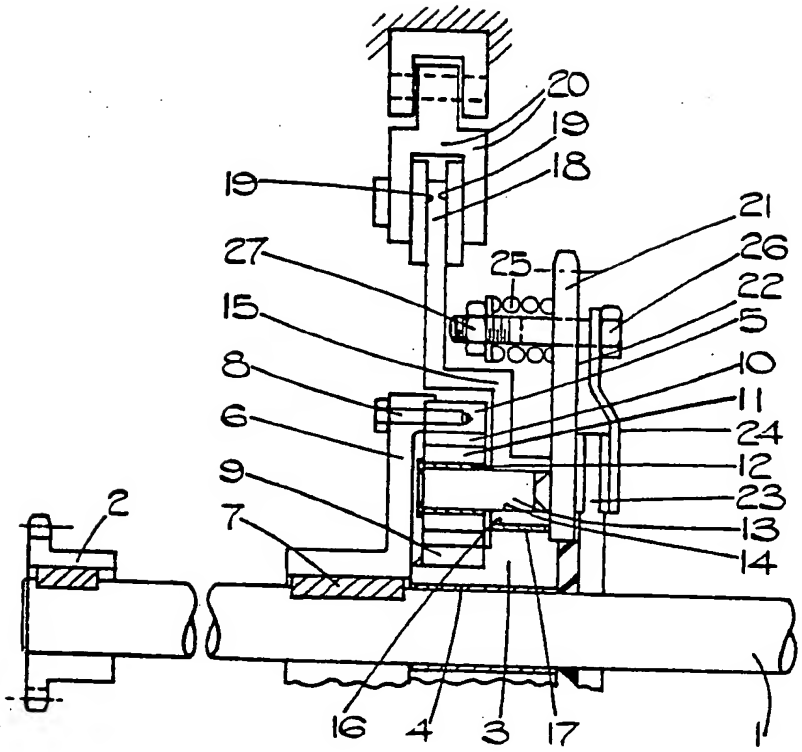

FIG.1

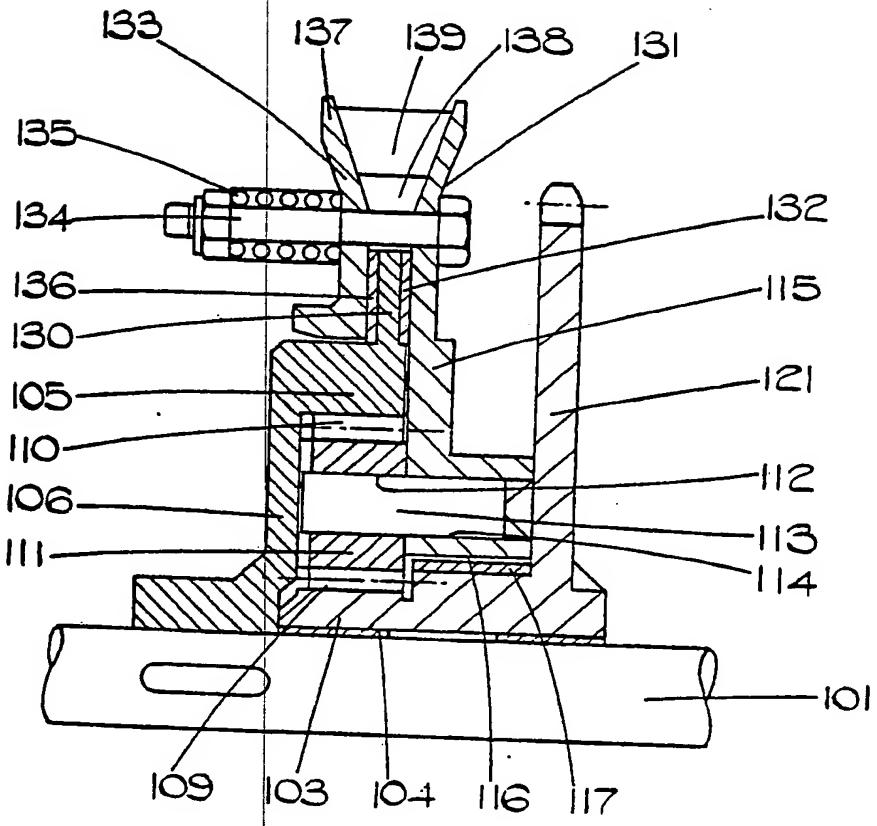

FIG.2.

SPECIFICATION

Drive reversal mechanism

The present invention relates to a drive reversal mechanism and is more particularly related to a drive reversal mechanism especially (but not exclusively) for use in a harvesting machine.

A typical design of harvester is described in GB 1124089 and comprises a conveyor feed mechanism consisting of circulating chains carrying a flexible band as a stalk engaging member and a cutting device at the inlet thereof. Most modern harvesters incorporate a reversing mechanism as part of the drive configuration. The purpose of such a device is to reverse the directon of rotation of part or the whole of the machine in order to remove foreign objects or blockages from within the feed area of the machine. The reversal can either by achieved by manual actuation or by using the normal machine power supply e.g tractor power take off or integral engine unit. Normally only the feed mechanism is reversed while the main cutting or chopping device is allowed to continue in its forward mode. The advantage of this feature is that the response time is much reduced as the inertia of the feed mechanism is normally considerably less than that of the chopping cylinder.

Alternative known devices commonly used to achieve this reversal can be categorised as follows:

1. Manual operation using a large wrench or lever. This is normally carried out with a power supply to the feed mechanism disconnected for safety reasons.

2. Special gear box. This requires the use of a second gear box on the machine which can be operated manually or remotely from the driving position.

3. Friction drive. This common method involves de-clutching the normal drive by, for example, slackening a drive belt to the feed mechanism. A pair of wheels are then brought together to produce a friction drive to the feed mechanism, the second wheel naturally having opposite rotation to the first wheel.

4. Magnetic clutches. These are used in conjunction with either chain or gear drives and the mode of operation usually entails two separate drive paths, one resulting in forward motion and the second in reverse motion. The clutches are used to engage and disengage the two drive parts respectively.

The present invention has as its object the provision of an improved form of drive reversal mechanism intended (but not exclusively) for use with crop harvesting machines.

According to one aspect of the present invention there is provided a drive mechanism comprising a rotatable input drive means and a rotatable output drive means, said rotatable output drive means normally being driven by said rotatable input drive means via a disengageable drive connection, said rotatable input drive means and said rotatable output drive means also being connected by a constant mesh epicyclic gear arrangement, the epicyclic gear arrangement comprising first, second and third parts, the first part being fixed relative to the rotatable input drive means, the second part being fixed relative to the rotatable output drive means and the third part engaging both the first and the second parts and being mounted on a rotatable carrier whereupon disengagement of the disengageable drive connection between said input drive means and said output drive means and the activation of braking means to prevent rotation of the rotatable carrier, drive is transmitted to the rotatable output drive means via the epicyclic gear mechanism such that the direction of rotation of the output drive means when driven via the epicyclic gear arrangement is opposite to the direction of rotation when it is normally driven.

The aforesaid braking means may comprise a friction surface on the rotatable carrier and a friction element which is engageable therewith. Alternatively, other devices (such as a pawl and ratchet mechanism) may be employed.

Acording to another aspect of the present invention there is provided a crop harvester comprising a feeder mechanim adapted in use to receive a crop which is to be harvested, said feeder mechanism being driven by a feeder drive means, a cutter mechanism arranged to be fed with the crop gathered by said feeder mechanism, said cutter mechanism being driven by a cutter drive mechanism and an outlet through which the crop cut by said cutter mechanism will in use be delivered; the feeder drive mechanism comprising a rotatable input drive means and a rotatable output drive means, said rotatable output drive means normally being driven by said rotatable input drive means via a disengageable drive connection, said rotatable input drive means and said rotatable output drive means also being connected by a constant mesh epicyclic gear arrangement, the epicyclic gear arrangement comprising first, second and third parts, the first part being fixed relative to the rotatable input drive means, the second part being fixed relative to the rotatable output drive means and the third part engaging both the first and second parts and being mounted on a rotatable carrier; whereupon disengagement of the disengageable drive connection between said rotatable input drive means and said rotatable output drive means and the activation of braking means to prevent rotation of the rotatable carrier, drive is transmitted to the rotatable output drive means via the epicyclic gear mechanism such that the direction of rotation of the rotatable output drive means when driven by the epicyclic gear arrangement is opposite to the direction of rotation when it is normally

driven, a feeder mechanism being connected to the rotatable output drive means of the drive mechanism such that reversal of the direction of rotation of the rotatable output drive means causes reversal of the feeder mechanism.

Preferably, the rotatable input drive means is a chain driven sprocket and the rotatable output drive means is a shaft which can have one or more further sprockets or gears or like members mounted thereon.

It is also preferred that the disengageable drive connection is a friction clutch.

Typically disengagement of the disengageable drive connection is caused by jamming of the feeder mechanism and reversal of the feeder drive mechanism is effected for example by urging a friction member against a friction surface provided on the rotatable carrier, causing reversal of the feeder mechanism in order to expel the cause of the jamming and allow normal drive to proceed. Alternatively other forms of braking means may be provided to stop rotation of the rotatable carrier.

Embodiments of the drive mechanism according to the first aspect of the present invention will now be described with reference to the accompanying drawings in which:

Fig. 1 is a part sectional view through a first embodiment of a drive mechanism, and

Fig. 2 is a part sectioned view through a second embodiment of a drive mechanism.

In Fig. 1 there is shown a drive mechanism comprising an output shaft 1 having a feeder drive sprocket 2 mounted thereon which drives a feeder mechanism (not shown) via a chain (also not shown). A first gear ring 3 is mounted on the shaft 1 on a sleeve bearing 4 so that it is free to rotate relative to the shaft 1. A second gear ring 5 is fixed relative to the shaft 1 by means of a hub 6 which is secured to the shaft 1 by a key 7. The second gear ring 5 is fixed to the hub 6 by means of retaining screws 8. The shaft 1, the first gear ring 3, the second gear ring 5 and the hub 6 are all concentric. Gear teeth are provided on the mutually opposite parts of the radially outward facing edge 9 of the first gear ring 3 and the radially inwardly facing edge 10 of the second gear ring 5. A plurality of toothed planet gears 11 are provided between the first gear ring 3 and the second gear ring 5, the teeth of the planet gears 11 engaging the teeth on the edges 9 and 10 of the gear rings 3 and 5. The planet gears 11 are mounted on sleeve bearings 12 on respective locating shafts 13 which are fixed in bores 14 provided in a carrier disk 15. The carrier disk 15 is concentric with the shaft 1 and is provided with an aperture 16 in its central portion through which the first gear ring 3 and the shaft 1 extend. A further sleeve bearing 17 is provided between the first gear ring 3 and the disk 15. Opposite sides of the periphery 18 of the disk 15 form friction surfaces 19 against which brake means 20 can be urged by a brake actuator means (not shown). An input drive sprocket 21 is fixed to the first gear ring 3 and is concentric with the shaft 1. The sleeve bearing 4 allows axial movement of the first gear ring 3 relative to the shaft 1. One face 22 of the sprocket 21 is engaged with a friction clutch plate 23 which is fixed relative to the shaft 1, the sprocket 21 being urged against the clutch plate by means of a pressure plate 24 mounted parallel to said one face 22 of the sprocket 21 by means of locating bolts 26. The pressure plate 24 is located on the opposite side of the friction clutch plate 23 to the sprocket 21 and the sprocket 21 and the pressure plate 24 are urged into engagement with the friction clutch plate 23 by means of compression springs 25 mounted on the bolts 26, adjusting nuts 27 being provided so that the the compression of the compression springs 25 may be adjusted. The sprocket 21 is driven by a chain (not shown) from a power source such as a tractor power take off.

In normal (forward) operation, drive is transmitted from the sprocket 21 to the shaft 1 via the friction clutch 23, at first gear ring 3, second gear ring 5 and planet gears 11 and the carrier disk 15 rotating with the shaft 1 and transmitting no drive thereto. However, if the feeder mechanism becomes jammed due to a build up of material being harvested or by the ingress of foreign bodies such as stones, the shaft 1 stops and the friction clutch plate 23 begins to slip relative to the sprocket 21 so that no drive is transmitted to the sprocket 21 to the shaft 1. At this stage the first gear ring 3 spins freely about the shaft 1 and, because the second gear ring 5 is fixed relative to the shaft 1 and so is stationary, said first gear ring 3 will cause the planet gear 11 and the carrier disk 15 to spin. Upon the actuation of the brake means 20 however the disk 15 is prevented from further rotation and drive is transmitted from the sprocket 21 by means of the first gear ring 3 through the planet gears 11 to a second gear ring 5 and hence to the shaft 1. This drive will be in the reverse direction compared with the normal direction of rotation and serves to expel any material causing jamming of the feeder mechanism. When the blockage has been cleared and the brake 20 is released, the carrier disk is allowed to rotate freely and drive in the forward direction is resumed via the friction clutch plate 23. The brake 20 may be actuated manually or remotely.

An alternative version of a drive reversal mechanism is shown in Fig. 2. In this embodiment, those parts which correspond to the parts identified in Fig. 1 will be given the same numbers in the 100 series.

In the alternative version, the hub 106 and second gear ring 105 are in the form of a

single piece ring gear attached to the output shaft 101. The periphery of the gear ring 105 is extended to form a clutch plate 130 which, as will be appreciated, is fixed relative to the output shaft 101.

The carrier disk 115 has a portion 131 which extends beyond the clutch plate 130, and is angled away therefrom. A friction pad 132 is attached to the disc 115 and engages one side of the plate 130.

A pulley ring 133 is attached to the disk 115 by means of a locating bolt 134 and compression spring 135. The ring 133 has the same outside diameter as the disk 115 and fits around the ring gear 105 on the opposite side of the clutch plate 130 from the disk 115 A further friction pad 136 is attached to the ring 133 and engages the plate 130 and the portion 137 of the ring 133 beyond the plate 130 is angled away from the portion 131 so that a tapering slot 138 is provided between the portions 131 and 137 around the clutch plate 130. The bolt 134 and compression spring 135 are adjusted so that the friction pads 132, 136 are urged against the clutch plate 130. A V-belt 139 is passed through the slot 138 and is attached to a fixed anchor at one end thereof (not shown) and to a brake actuating means at the other end thereof (also not shown).

In use, drive is transmitted from the input sprocket 121 to the output shaft 101 via the planet gears 111, the carrier disk 115 and pulley ring 132, friction pads 132,136, second g ar ring 105 and the hub 106. In this case drive is transmitted to the clutch plate 130 through the friction pads 132 and 136 and the whole arrangement rotates with the output shaft, the V-belt 139 slipping through the slot 138.

When a blockage is encountered and the output shaft is prevented from rotating the clutch pad is caused to slip relative to the carrier disk arrangement which is in turn caused to spin as described in the previous arrangement. Application of the brake actuating means forces the V-belt 139 into the slot 138 causing the carrier disk arrangement to be locked in position and also serving to move the portions 131 and 137, and also friction pads 132 and 136 away from the clutch plate 130. This locking of the carrier disk arrangement causes drive to be transmitted to the output shaft in the reverse direction as previously described.

Normal drive is resumed by releasing the V-belt 139 which allows normal forward drive to be transmitted to the output shaft as described above.

CLAIMS

1. A drive mechanism comprising a rotatable input drive means and a rotatable output drive means, said rotatable output drive means normally being driven by said rotatable input drive means via a disengageable drive connection, said rotatable input drive means and said rotatable output drive means also being connected by a constant mesh epicyclic gear arrangement, the epicyclic gear arrangement comprising first, second and third parts, the first part being fixed relative to the rotatable input drive means, the second part being fixed relative to the rotatable output drive means and the third part engaging both the first and the second parts and being mounted on a rotatable carrier whereupon disengagement of the disengageable drive connection between said input drive means and said output drive means and the activation of braking means to prevent rotation of the rotatable carrier, drive is transmitted to the rotatable output drive means via the epicyclic gear mechanism such that the direction of rotation of the output drive means when driven via the epicyclic gear arrangement is opposite to the direction of rotation when it is normally driven.

2. A drive mechanism as claimed in claim 1 wherein the aforesaid braking means may comprise a friction surface on the rotatable carrier and a friction element which is engageable therewith.

3. A drive mechanism as claimed in claim 2 wherein the friction surface is in the form of a disk and the friction element is a brake pad.

4. A drive mechanism as claimed in claim 2 wherein the friction surface is in the form of a groove in a pulley and the friction element is a brake belt.

5. A drive mechanism as claimed in any preceding claim wherein the rotatable input drive means is a chain.

6. A drive mechanism as claimed in any preceding claim wherein the rotatable output drive means is a shaft which can have one or more further sprockets or gears or like members mounted thereon.

7. A drive mechanism as claimed in any preceding claim wherein the disengageable drive connection is a friction clutch.

8. A crop harvester comprising a feeder mechanim adapted in use to receive a crop which is to be harvested, said feeder mechanism being driven by a feeder drive means, a cutter mechanism arranged to be fed with the crop gathered by said feeder mechanism, said cutter mechanism being driven by a cutter drive mechanism and an outlet through which the crop cut by said cutter mechanism will in use be delivered; the feeder drive mechanism comprising a rotatable input drive means and a rotatable output drive means, said rotatable output drive means normally being driven by said rotatable input drive means via a disengageable drive connection, said rotatable input drive means and said rotatable output drive means also being connected by a constant mesh epicyclic gear arrangement, the epicyclic gear arrangement comprising first, second and third parts, the first part being fixed relative to

the rotatable input drive means, the second part being fixed relative to the rotatable output drive means and the third part engaging both the first and second parts and being mounted on a rotatable carrier; whereupon disengagement of the disengageable drive connection between said rotatable input drive means and said rotatable output drive means and the activation of braking means to prevent rotation of the rotatable carrier, drive is transmitted to the rotatable output drive means via the epicyclic gear mechanism such that the direction of rotation of the rotatable output drive means when driven by the epicyclic gear arrangement is opposite to the direction of rotation when it is normally driven, a feeder mechanism being connected to the rotatable output drive means of the drive mechanism such that reversal of the direction of rotation of the rotatable output drive means causes reversal of the feeder mechanism.

9. A drive mechanism as claimed in claim 1, substantially as hereinbefore described with reference to the accompanying drawings.

10. A crop harvester as claimed in claim 8 incorporating a drive mechanism substantially as hereinbefore described with reference to the accompanying drawings.

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